# Lecture 4 Methods in Neuroscience

→ **Railroad construction foreman Phineas Gage**
  - Original person with conscientiousness, attention to detail
  - Rod struck through brain → lived, could still reason, but self control gone
    | "The equilibrium or balance, so to speak, between his intellectual faculties and animal propensities, seems to have been destroyed."

⚠ Phrenology — some pseudoscience
  - Touching for bumps in skull to tell what each part does. Bad idea lol.

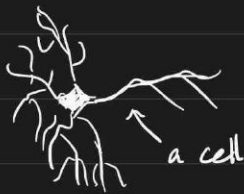## #1 Individual Cell Techniques

\* **Nissil** stain



↑
every cell, lets you
count, not detailed
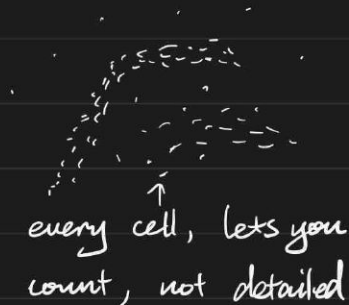
\* **Myelin stain**

Stains myelin (duh)

\* **Immunocytochemical / Neurogenesis**
Use immune system to see new cells

\* **Golgi stain**



a cell

subset of cells,
see structure!

\* **Single cell recording**

cell $\xrightarrow{\text{electrode}}$ signal

\* **Single cell stimulation**

signal $\xrightarrow{\text{electrode}}$ cell

#2  Lesioning  Techniques

* Permanent lesion — take out and... gone
  - Aspirational
  - Electrolytic
  - Radio-frequency
  - Neurochemical (kainic acid)
  - Knife cut

* Temporary lesion
  - Cryogenic using Cryoprobe
    Freezes part of brain

* Naturally caused lesion
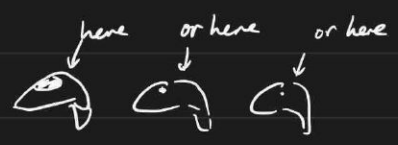  - Stroke (could be temporary or permanent)
  - External injury

⚠ Problems with these
  1. No random assignment
  2. May be multiple parts damaged
  3. Don't know exactly what's impaired

# #3 Imaging Techniques

* **Considerations:**
    - Spacial resolution — is location exact?
    - Temporal ... — is when exact?
    - Invasiveness — any harm?

here   or here   or here

| | Spacial | Temporal | Invasiveness |
|---|---|---|---|
| **EEG** Electroencephalography | ☹ | ☺ | None |
| **MEG** Magnetoencephalography | ☹ | ☺ | None |
| **PET** Positron Emission Tomography (2-deoxyglucose flow, radiative tracing drug) | ☺ | ☹ | Some (radioactive) |
| **fMRI** Functional Magnetic Resonance Imaging ($O_2$ flow) | ☺ | ☹ | None |
| **MRS** Magnetic Resonance Spectroscopy (Neurochemical flow) | | | |

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**TMS** Transcranial Magnetic stimulation
(Activates part of brain from outside)

☺ outskirt
☹ middle
☹ inside

☺   ?

# #4 Problems

⚠ **Reverse inference**
- If p then q, q then p.  No.
- If A lights up when B, then when B then A lights up.  No.

⚠ **Seductive Allure**

Tendency to believe in neurosci data even when irrelevant / poor inference, etc.